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THE PRE-GLACIAL COURSE OF THE MIDDLE PORTION OF THE GENESEE RIVER. *

BY

R. H. WHITBECK.

INTRODUCTION.—Rising in northern Pennsylvania, the Genesee river flows northward across New York and empties into Lake Ontario at Charlotte, not far from the City of Rochester. The river, with its tributaries, drains an area of about 2,500 square miles.† The course of the river is divided into four distinctly-marked portions:

(a) From its headwaters to the village of Portageville it flows in its pre-glacial valley. For some twenty miles south from Portageville the valley bottom has an average width of about one mile (Fig. 5), being a little broader than this in some parts. This portion of the valley is deeply filled with silt, the actual depth of which is not known.

(b) From Portageville to Mount Morris the river now flows in a rock gorge (Figs. 3, 4, 7, 8, 9), in part, at least, post-glacial. For several miles below Portageville the gorge is narrow, and the rock sides are precipitous (Fig. 4), the water flowing on a rock bottom. In this portion are the celebrated Genesee Falls, called respectively the Upper, Middle, and Lower Falls. A short distance below the last fall the character of the gorge changes. The channel becomes broader and the side walls more sloping, all the features indicating that this portion of the gorge is older than that immediately above. This continues but a short distance, when, by a sharp curve to the left, the river again follows a narrow gorge, plainly post-glacial; but, after describing a U-shaped curve, the river again flows in a broader and older channel, ranging in width from $\frac{1}{3}$ to $\frac{3}{4}$ of a mile. In this latter portion the valley-bottom is filled with till, and the river does not flow on rock. There are many facts which cannot be introduced into this paper which strongly suggest the existence here of an "inter-glacial gorge." The broader gorge continues nearly to Mount Morris, when, by making another circuit, the river again flows in a narrow post-glacial rock-cutting (Fig. 8),

* The original work upon which this paper is based was done for a thesis at Cornell University.

† Report of John Bogart, State Engineer and Surveyor of New York, 1890.

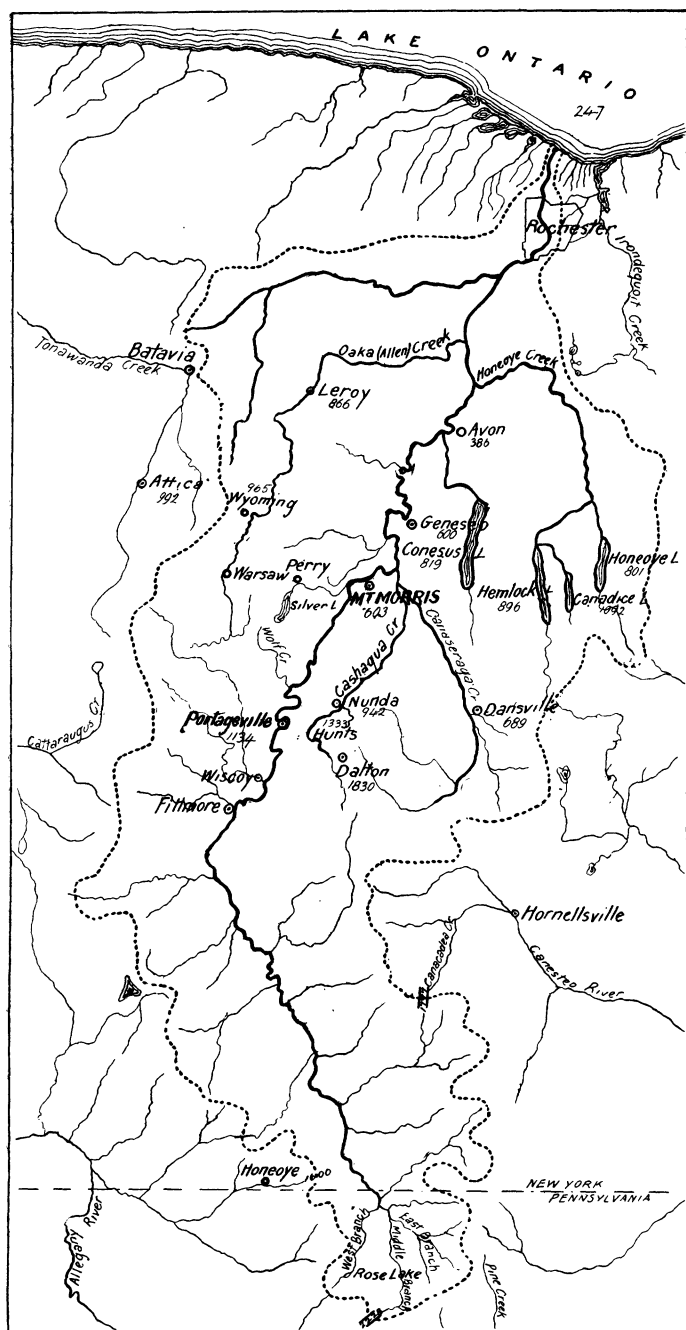


FIG. 1.—MAP OF GENESEE DRAINAGE BASIN.

Correction.—AT AVON THE ELEVATION IS 586 FEET; AT DALTON 1,330 FEET.

and afterwards emerges into a broad, ancient depression, the Lower Genesee valley (Fig. 9).

(*c*) From Mount Morris to Rochester the river flows in a pre-glacial valley, broad, flat-bottomed, and filled with silt to a depth of about 200 feet, as is shown by borings at Mount Morris, Cuyler-ville, and elsewhere. As the river approaches Rochester, the valley becomes less and less distinct, and blends into a plain.

(*d*) From Rochester to Lake Ontario the Genesee flows in a narrow, post-glacial gorge, near the head of which are three falls of 98, 20, and 105 feet in height respectively.

TOPOGRAPHY OF THE PORTAGEVILLE-MOUNT MORRIS PORTION OF THE GENESEE BASIN.—The region with which this paper is chiefly concerned is the portion of the Genesee drainage basin lying between the latitude of Portageville on the south and Mount Morris on the north (Fig. 2). At the former village a vast accumulation of moraine (Fig. 2) has so filled the ancient valley that the river has been turned aside into a new course. At the latter village, some fifteen miles north, the river returns to its pre-glacial valley (Fig. 9).

In its middle portion the drainage basin of the Genesee is about forty miles wide. In both its upper and its lower courses the river flows very nearly in the middle of its basin (Fig. 1), but the present Portageville-Mount Morris gorge is some six miles west of the middle. The whole region slopes northward as well as toward the middle of the basin; hence the larger tributaries generally join the river some miles north of their sources.

A very significant fact, and one which will be made use of later, is that from the western divide the surface of the land slopes eastward until the Cashaqua valley is reached, and that this valley lies almost exactly in the middle of the Genesee basin in this portion (Fig. 1). Between the western divide and this valley are three north-south depressions. If these depressions were filled to the level of their bounding ridges we should have a gently-sloping surface extending from the divide on the west to the bottom of the Cashaqua valley. (Fig. 6 shows a cross-section of the region.)

THE PRE-GLACIAL COURSE OF THE GENESEE NORTH OF PORTAGEVILLE.—It has already been explained that the river was diverted from its original course by a great mass of terminal moraine at Portageville (Fig. 2). Here the river swings to the left and enters the rock-walled gorge already mentioned. The old

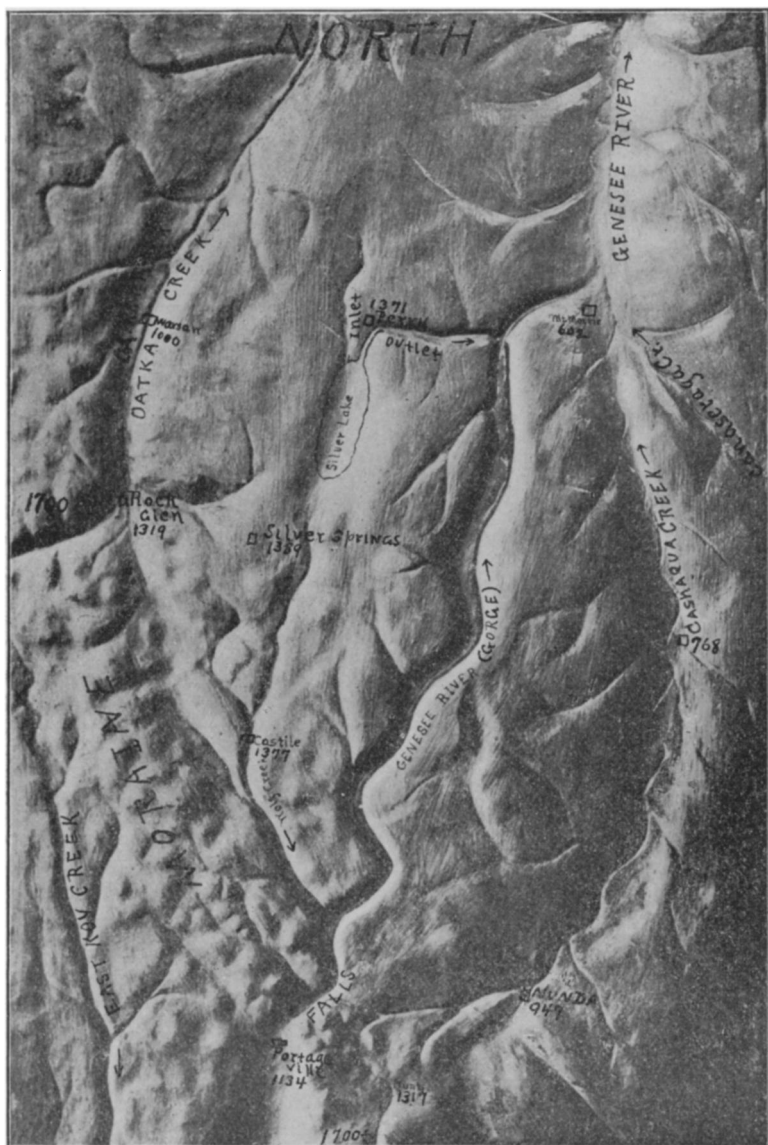


FIG. 2.—RELIEF OF A PORTION OF THE GENESEE DRAINAGE BASIN. MODEL BY R. H. WHITBECK. SCALE ABOUT $3\frac{1}{2}$ MILES TO THE INCH.

valley, buried by the moraine, must necessarily lie on one side or the other of the present gorge. It must, of course, be a valley whose direction, width, depth, and position in the Genesee basin are substantially the same as the direction, width, etc., of the Genesee valley above Portageville, for it is merely a continuation of that valley, partitioned off from it by the mass of moraine. Prof. Chamberlin says: "Probably the buried valley lies to the *east* of the present rock channel."* Prof. Fairchild† is of the opinion that the Cashaqua valley, on the *east*, is the pre-glacial Genesee valley, but says in a personal letter that it is "a new field." Prof. Grabau has written a paper ‡ in which he argues in

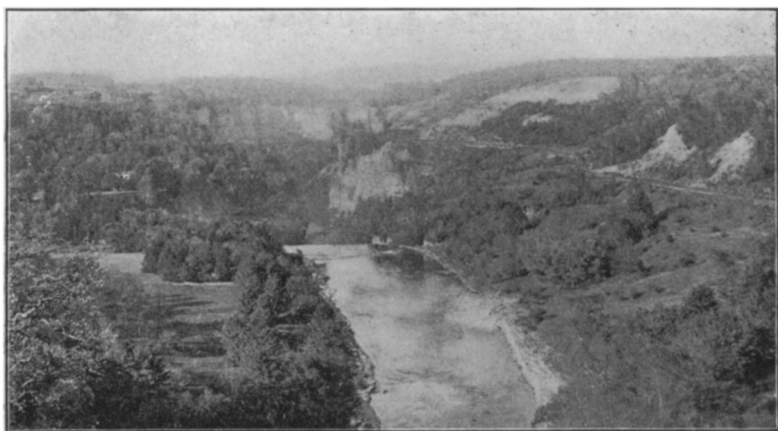


FIG. 3.—UPPER GENESSEE GORGE AT MIDDLE FALLS, VIEWED FROM ERIE R.R. BRIDGE (LOOKING NORTH). HERE THE GORGE CUTS ACROSS A LARGE, BURIED, EAST-WEST-VALLEY.

favor of the Oatka valley on the *west*. This paper makes no mention whatever of the Cashaqua valley. Whichever of the two suggested courses is the real one, that course must present the following characteristics:

(1) A pre-glacial valley not less than one mile wide and having a direction, shape, and altitude of bottom substantially the same as the present Genesee valley has at Portageville.

(2) There will be a buried portion of this valley extending northward from Portageville, and merging into it after passing the moraine deposits.

(3) Having been the course of the trunk stream, the valley

* Third Ann. Rept. U. S. G. S., p. 351.

† Bull. Geol. Soc. Amer., 1896, VII.

‡ Proc. Boston Soc. Nat. Hist., 1894, XXXII.

should lie near the middle of the Genesee basin, and toward it there should be a general slope from both sides.

Which of the two valleys, then, the Oatka or the Cashaqua, fulfils these conditions?

REGARDING THE OATKA VALLEY.—This valley is best defined at the village of Warsaw. Here the valley bottom, by actual survey, is just two-thirds of a mile in width (Fig. 5). North of Warsaw the valley broadens rapidly, and in less than twenty miles blends into a plain so level as to be selected as a route for several east and west railways. Nor does there appear to be any possibility that this plain is due to the filling of a large pre-glacial

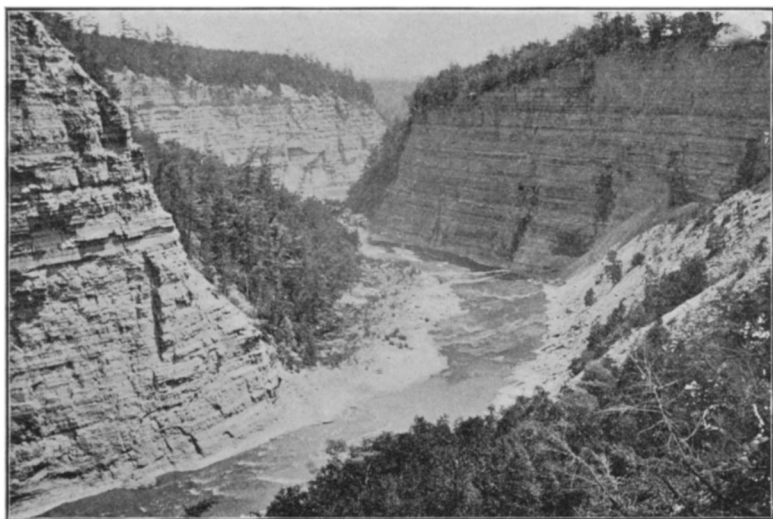


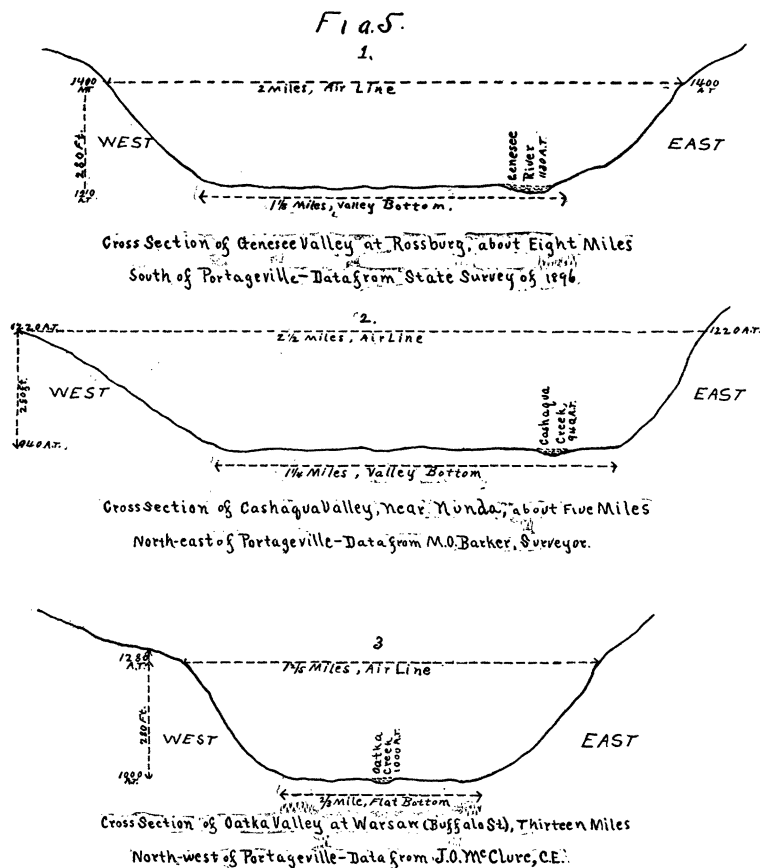
FIG. 4.—GENESEE GORGE BETWEEN MIDDLE AND LOWER FALLS.

valley, for the region is perforated with salt wells; yet the depth of drift at Wyoming, Pearl Creek, Pavilion, and Leroy nowhere exceeds fifty feet. Beyond Leroy the Oatka flows over a plain with rock everywhere near the surface. The till sheet is very thin, with no moraines to obscure an old valley, if one existed; yet no evidence of any valley at all adequate to have been that of the pre-glacial Genesee is to be found. So scanty are the glacial deposits in this region that a valley such as the Genesee would have demanded could not exist and remain undiscovered.

So much for the Oatka valley north of Warsaw. For five or six miles south of that village the valley continues, though growing

more and more poorly defined. At Silver Springs it may be said to cease. The hills rise to a considerable height on the western side, but there is only a slight elevation on the east.

From Silver Springs to Portageville, seven miles, there is no valley, either visible or buried, which can be regarded as a connec-

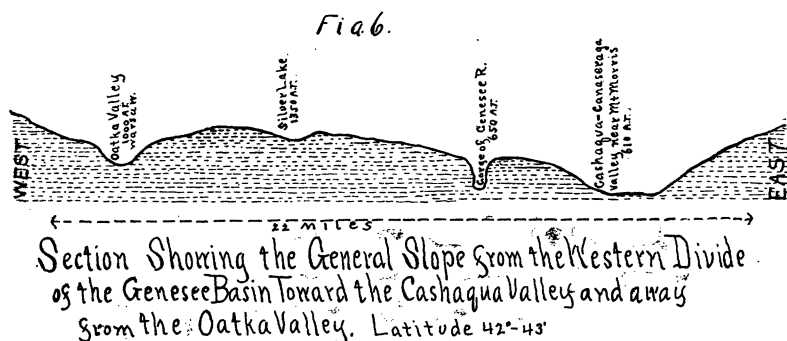


CROSS SECTIONS TENDING TO SHOW THAT 2 MAY PROPERLY BE CONSIDERED A DOWN-STREAM CONTINUATION OF 1, WHILE 3 MAY NOT BE SO CONSIDERED.

tion between the Oatka valley and the Genesee valley. The rock lies near the surface. At Castile a salt-well-boring passes through about fifty feet of drift. This is the deepest deposit known in the Castile depression, while near the middle of the depression Wolf Creek flows on a rock bottom. The rock here has an elevation of over 1,300 feet above tide; while the river bottom at Portageville has an elevation of only 1,100 feet, and the rock is known to be

not less than seventy feet below. There is, then, no evidence of a buried valley which joins the Oatka and the upper Genesee valleys.

Further evidence tending to disqualify the Oatka valley is found in its *elevation* and *position* in the Genesee basin. This portion of the Genesee drainage area is about forty miles in width. The lowest land is in the middle of the basin. The Oatka valley extends along the western margin, its western slope culminating in the Lake Erie divide, and the bottom of the valley in places being only four or five miles from the divide (see Fig. 1). Moreover, *no important tributaries flow toward this valley*, all flowing toward the middle of the basin, which is between three hundred and four hundred feet lower than the Oatka valley bottom. It is scarcely conceiv-



able that the Genesee could have followed a course thirty-five miles from one side of its basin and only five miles from the other side when a much more natural course and much lower land is found through the middle of its drainage basin.

Gathering together these facts, we find: (1) that the Oatka valley, in its best-defined portion, is more than one-third narrower than the Genesee valley above Portageville; (2) that no connecting link between the Oatka valley and the Genesee at Portageville can be traced; (3) that the valley is high up on one side of the Genesee basin, and close to the western divide; and (4) that the general surface of the land slopes, not towards the Oatka valley, but away from it, toward the middle of the Genesee basin.

REGARDING THE CASHAQUA VALLEY. — From the village of Nunda, a few miles northeast of Portageville, a perfectly-defined pre-glacial valley extends northward, and merges into the broad Genesee valley near Mount Morris (Fig. 2). At the south, this valley ends almost abruptly near Hunts, on account of a vast accu-

mulation of moraine. In the Third Annual Report of the United States Geological Survey, page 352, Chamberlin says: "A few miles east of Portageville the moraine is forced against the high hills that lie south of Hunts and Dalton, and becomes a great irregular terrace banked against them." Again he says: "It is not improbable that the moraine accumulations at the centre of the valley have a depth of five or six hundred feet." A relatively small stream, the Cashaqua Creek, rising in the high hills south of Dalton, flows through the valley. It is at once evident that the pre-glacial representative of the Cashaqua Creek must have been a very much larger stream, and that it rose much farther south; for

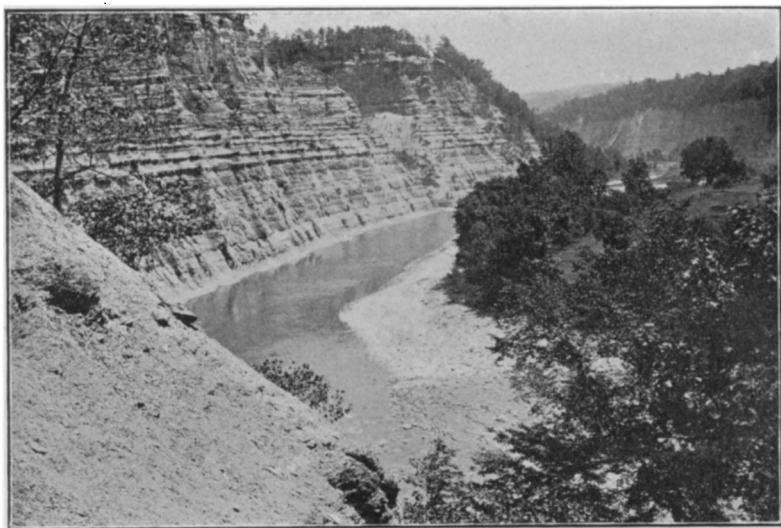


FIG. 7.—GENESEE GORGE BELOW LOWER FALLS. ENTRANCE OF WOLF CREEK AT CENTRE, LEFT.

as soon as the valley at its southern end is clear of moraine it is fully a mile wide, and maintains a width of one mile or more for its entire length. Manifestly this broad depression, with gently sloping sides, does not spring abruptly into existence at Hunts, but is a *continuation of some valley* from which it has been partitioned by the moraine, which here fills it. That it is the continuation of the *Genesee valley* does not seem difficult to establish.

It has already been pointed out that the broad upper Genesee valley is abruptly terminated at Portageville by the moraine, and that no northward continuation of this valley can be traced on the *west* of the present gorge.

Three or four miles to the east, however, we find the Cashaqua

valley beginning almost as abruptly as the Genesee valley ends, and between the two a great mass of terminal moraine several hundred feet in depth. In width and general outline, the Cashaqua valley bears the closest resemblance to the upper Genesee valley. The high hills which form the eastern rim of the upper Genesee valley continue on in an almost unbroken line to form the eastern rim of the Cashaqua valley. That is, the eastern slope of the Genesee and Cashaqua valleys is one continuous range of hills.

From its headwaters to Portageville the Genesee flows very nearly in the middle of its drainage basin. The same is true of the lower Genesee from Mount Morris to Rochester; and it is a fact of significance that the Cashaqua valley for its entire length occupiee

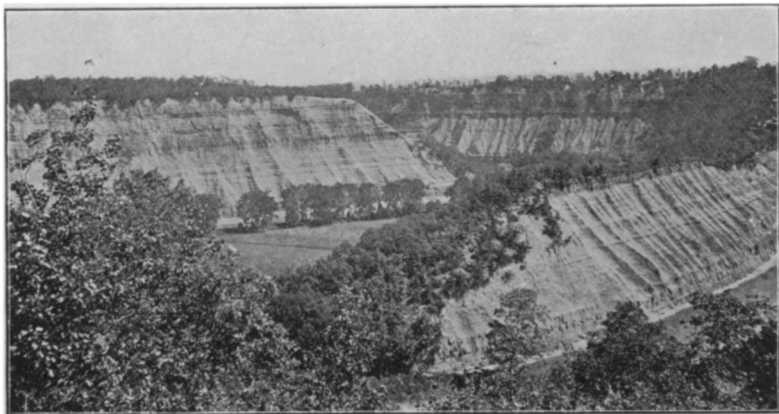


FIG. 8.—SHOWING ONE OF THE GREAT LOOPS, MADE BY THE GENESSEE RIVER ABOVE MT. MORRIS. THE ROCK TONGUE AT THE RIGHT IS CALLED THE HOGBACK.

almost the exact middle of the Genesee drainage basin in the very area where the Genesee departs from the median line.

Not alone does the Cashaqua valley lie in the middle of the Genesee basin, but toward it the land slopes all the way from the western divide. A study of the map (Fig. 1) shows that between the Cashaqua valley and the western divide the tributary streams flow eastward. No streams of any importance flow into the Oatka, or into the Silver Lake depression, or into the present Genesee gorge from the east. The cross-section of the basin shown in Figure 6 explains the reason for this—the land slopes constantly eastward toward the Cashaqua valley as though this were the trunk valley of the basin. This is in strongest contrast to the case of the Oatka valley.

Thus, by reason of size, shape, position, and elevation the Cashagua valley may well be the connecting link between the upper and lower courses of the pre-glacial Genesee. To substantiate this it will be necessary to determine the existence of the buried portion of the valley between Portageville and Hunts. On the Portageville end the buried valley is well shown, and its existence is recognized by all who have written upon the region. Quoting again from Prof. Chamberlin's report, he says on page 351: "To the east the moraine rises in a ridge 425 feet above the flood plain of the river at Portageville."

Here the river has cut into the drift, not only exposing a fresh surface, but also exposing a portion of the western rock wall of the buried valley. The opposite wall, which should be about a mile



FIG. 9.—GENESEE GORGE JUST ABOVE MT. MORRIS. HERE THE RIVER RETURNS TO ITS PRE-GLACIAL VALLEY. THE HILLS IN THE DISTANCE ARE THE EASTERN SLOPE OF THE ANCIENT VALLEY.

and a half up the river, is not visible on account of the forest-covering; but its existence is shown by well-borings in the vicinity, and is revealed by streams flowing down its slope. While the moraine is very deep, yet it does not rise to the level of the hill-tops on the southeast, but forms great irregular terraces against the hillsides. In these terraces deep wells have been drilled. One of the wells nearer the margin of the buried valley reaches the rock at a depth of 70 feet below the surface; another well, one-fourth mile toward the middle of the valley, did not reach rock at a depth of 166 feet, thus showing a slope of the rock bottom in the direction which would be expected on the assumption that a buried valley exists.

Two or three little streams flow down from these high hills into

- [illegible]